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Synthesizing bidirectional texture functions for ... - by Liu - 52 citations
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vation has **homogeneous reflectance** properties. While we ... A **parametric texture** model. based on joint statistics of complex wavelet coefficients. Int. ...
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Computer Graphics, Spring 2004

Write the equation for the Phong model of **surface reflectance** including ... For each, give an example object for which the **texture map** would be useful. ...
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1 Decoupling BRDFs from surface mesostructures

Jan Kautz, Mirko Sattler, Ralf Sarlette, Reinhard Klein, Hans-Peter Seidel

May 2004 **Proceedings of the 2004 conference on Graphics interface GI '04**

Publisher: Canadian Human-Computer Communications Society

Full text available: pdf(582.03 KB) Additional Information: full citation, abstract, references

We present a technique for the easy acquisition of realistic materials and mesostructures, without acquiring the actual BRDF. The method uses the observation that under certain circumstances the mesostructure of a surface can be acquired independently of the underlying BRDF.The acquired data can be used directly for rendering with little preprocessing. Rendering is possible using an offline renderer but also using graphics hardware, where it achieves real-time frame rates. Compelling results are ...

Keywords: graphics hardware, reflectance, texture mapping

2 Synthesizing bidirectional texture functions for real-world surfaces

Xinguo Liu, Yizhou Yu, Heung-Yeung Shum

August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**

Publisher: ACM Press

Full text available: pdf(4.30 MB) Additional Information: full citation, abstract, references, citings, index terms

In this paper, we present a novel approach to synthetically generating bidirectional texture functions (BTFs) of real-world surfaces. Unlike a conventional two-dimensional texture, a BTF is a six-dimensional function that describes the appearance of texture as a function of illumination and viewing directions. The BTF captures the appearance change caused by visible small-scale geometric details on surfaces. From a sparse set of images under different viewing/lighting settings, our approach g ...

Keywords: bidirectional texture functions, image-based rendering, photometric stereo, reflectance and shading models, shape-from-shading, texture synthesis

3 A signal-processing framework for reflection

Ravi Ramamoorthi, Pat Hanrahan

October 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 4

Publisher: ACM Press
Full text available: pdf(272.24 KB) Additional Information: full citation, abstract, references, index terms

We present a signal-processing framework for analyzing the reflected light field from a homogeneous convex curved surface under distant illumination. This analysis is of theoretical interest in both graphics and vision and is also of practical importance in many computer graphics problems---for instance, in determining lighting distributions and bidirectional reflectance distribution functions (BRDFs), in rendering with environment maps, and in image-based rendering. It is well known that und ...

Keywords: BRDF, Fourier analysis, environment maps, illumination, inverse rendering, reflection, signal processing, spherical harmonics

4 Inverse global illumination: recovering reflectance models of real scenes from photographs
Yizhou Yu, Paul Debevec, Jitendra Malik, Tim Hawkins
July 1999 **Proceedings of the 26th annual conference on Computer graphics and interactive techniques**
Publisher: ACM Press/Addison-Wesley Publishing Co.
Full text available: pdf(475.61 KB) Additional Information: full citation, references, citings, index terms

Keywords: BRDF models, albedo maps, global illumination, image-based modeling and rendering, radiance, radiosity, reflectance recovery, rendering

5 A microfacet-based BRDF generator
Michael Ashikmin, Simon Premože, Peter Shirley
July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques**
Publisher: ACM Press/Addison-Wesley Publishing Co.
Full text available: pdf(600.23 KB) Additional Information: full citation, abstract, citings, index terms

A method is presented that takes as an input a 2D microfacet orientation distribution and produces a 4D bidirectional reflectance distribution function (BRDF). This method differs from previous microfacet-based BRDF models in that it uses a simple shadowing term which allows it to handle very general microfacet distributions while maintaining reciprocity and energy conservation. The generator is shown on a variety of material types.

Keywords: reflectance & shading models, rendering

6 A signal-processing framework for inverse rendering
Ravi Ramamoorthi, Pat Hanrahan
August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**
Publisher: ACM Press
Full text available: pdf(1.01 MB) Additional Information: full citation, abstract, references, citings, index terms, review

Realism in computer-generated images requires accurate input models for lighting, textures and BRDFs. One of the best ways of obtaining high-quality data is through measurements of scene attributes from real photographs by *inverse rendering*. However, inverse rendering methods have been largely limited to settings with highly controlled lighting. One of the reasons for this is the lack of a coherent mathematical framework for

inverse rendering under general illumination conditions. Our ...

Keywords: BRDF, illumination, inverse rendering, irradiance, light field, radiance, signal processing, spherical harmonics

7 Reflection from layered surfaces due to subsurface scattering

Pat Hanrahan, Wolfgang Krueger
September 1993 **Proceedings of the 20th annual conference on Computer graphics and interactive techniques**
Publisher: ACM Press
Full text available: pdf(707.86 KB) Additional Information: full citation, references, citings, index terms

Keywords: Monte Carlo, integral equations, reflection models

8 Measuring bidirectional texture reflectance with a kaleidoscope

Jefferson Y. Han, Ken Perlin
July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3
Publisher: ACM Press
Full text available: pdf(23.88 MB) Additional Information: full citation, abstract, references, citings, index terms

We describe a new technique for measuring the bidirectional texture function (BTF) of a surface that requires no mechanical movement, can measure surfaces *in situ* under arbitrary lighting conditions, and can be made small, portable and inexpensive. The enabling innovation is the use of a tapered kaleidoscope, which allows a camera to view the same surface sample simultaneously from many directions. Similarly, the surface can be simultaneously illuminated from many directions, using only a ...

Keywords: BRDF, BTF, image-based rendering, realistic image synthesis, reflection models

9 Homomorphic factorization of BRDFs for high-performance rendering

Michael D. McCool, Jason Ang, Anis Ahmad
August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**
Publisher: ACM Press
Full text available: pdf(2.33 MB) Additional Information: full citation, abstract, references, citings, index terms

A bidirectional reflectance distribution function (BRDF) describes how a material reflects light from its surface. To use arbitrary BRDFs in real-time rendering, a compression technique must be used to represent BRDFs using the available texture-mapping and computational capabilities of an accelerated graphics pipeline. We present a numerical technique, homomorphic factorization, that can decompose arbitrary BRDFs into products of two or more factors of lower dimensionality, each factor de ...

***Keywords**: hardware accelerated rendering and shading*

10 Object shape and reflectance modeling from observation

Yoichi Sato, Mark D. Wheeler, Katsushi Ikeuchi
August 1997 **Proceedings of the 24th annual conference on Computer graphics and**

interactive techniques
Publisher: ACM Press/Addison-Wesley Publishing Co.
Full text available: pdf(1.11 MB) Additional Information: full citation, references, citings, index terms

11 Projectors: advanced graphics and vision techniques
Ramesh Raskar
August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes GRAPH '04**
Publisher: ACM Press
Full text available: pdf(6.53 MB) Additional Information: full citation

12 A practical model for subsurface light transport
Henrik Wann Jensen, Stephen R. Marschner, Marc Levoy, Pat Hanrahan
August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**
Publisher: ACM Press
Full text available: pdf(2.45 MB) Additional Information: full citation, abstract, references, citings, index terms

This paper introduces a simple model for subsurface light transport in translucent materials. The model enables efficient simulation of effects that BRDF models cannot capture, such as color bleeding within materials and diffusion of light across shadow boundaries. The technique is efficient even for anisotropic, highly scattering media that are expensive to simulate using existing methods. The model combines an exact solution for single scattering with a dipole point source diffusion approxi ...

Keywords: BSSRDF, diffusion theory, light transport, realistic image synthesis, reflection models, subsurface scattering

13 Image-based reconstruction of spatial appearance and geometric detail
Hendrik P. A. Lensch, Jan Kautz, Michael Goesele, Wolfgang Heidrich, Hans-Peter Seidel
April 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 2
Publisher: ACM Press
Full text available: pdf(302.22 KB) Additional Information: full citation, abstract, references, citings, index terms

Real-world objects are usually composed of a number of different materials that often show subtle changes even within a single material. Photorealistic rendering of such objects requires accurate measurements of the reflection properties of each material, as well as the spatially varying effects. We present an image-based measuring method that robustly detects the different materials of real objects and fits an average bidirectional reflectance distribution function (BRDF) to each of them. In or ...

Keywords: BRDF measurement, normal map acquisition, photometric stereo, shape from shading, spatially varying BRDFs

14 Transparency & translucency: Modeling and rendering of quasi-homogeneous materials
Xin Tong, Jiaping Wang, Stephen Lin, Baining Guo, Heung-Yeung Shum
July 2005 **ACM Transactions on Graphics (TOG)**, Volume 24 Issue 3
Publisher: ACM Press

Full text available: pdf(1.23 MB) Additional Information: full citation, abstract, references, index terms

Many translucent materials consist of evenly-distributed heterogeneous elements which produce a complex appearance under different lighting and viewing directions. For these *quasi-homogeneous* materials, existing techniques do not address how to acquire their material representations from physical samples in a way that allows arbitrary geometry models to be rendered with these materials. We propose a model for such materials that can be readily acquired from physical samples. This material ...

Keywords: reflectance and shading models, rendering, subsurface scattering

15 High dynamic range imaging

Paul Debevec, Erik Reinhard, Greg Ward, Sumanta Pattanaik

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes GRAPH '04**

Publisher: ACM Press

Full text available: pdf(20.22 MB) Additional Information: full citation, abstract

Current display devices can display only a limited range of contrast and colors, which is one of the main reasons that most image acquisition, processing, and display techniques use no more than eight bits per color channel. This course outlines recent advances in high-dynamic-range imaging, from capture to display, that remove this restriction, thereby enabling images to represent the color gamut and dynamic range of the original scene rather than the limited subspace imposed by current monitor ...

16 Measurement and color matching: Efficient isotropic BRDF measurement

Wojciech Matusik, Hanspeter Pfister, Matthew Brand, Leonard McMillan

June 2003 **Proceedings of the 14th Eurographics workshop on Rendering EGRW '03**

Publisher: Eurographics Association

Full text available: pdf(5.65 MB) Additional Information: full citation, abstract, references, citings

In this paper we present novel reflectance measurement procedures that require fewer total measurements than standard uniform sampling approaches. First, we acquire densely sampled reflectance data for a large collection of different materials. Using these densely sampled measurements we analyze the general surface reflectance function to determine the local signal variation at each point in the function's domain. We then use wavelet analysis to derive a common basis for all of the acquired refl ...

17 Real-time rendering of translucent meshes

Xuejun Hao, Amitabh Varshney

April 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 2

Publisher: ACM Press

Full text available: pdf(4.66 MB) Additional Information: full citation, abstract, references, index terms

Subsurface scattering is important for photo-realistic rendering of translucent materials. We make approximations to the BSSRDF model and propose a simple lighting model to simulate the effects on translucent meshes. Our approximations are based on the observation that subsurface scattering is relatively local due to its exponential falloff.In the preprocessing stage we build subsurface scattering neighborhood information, which includes all the vertices within effective scattering range from ea ...

Keywords: BSSRDF, local illumination, reflection models, subsurface scattering

18 Transparency & translucency: Light diffusion in multi-layered translucent materials

Craig Donner, Henrik Wann Jensen

July 2005 **ACM Transactions on Graphics (TOG)**, Volume 24 Issue 3
Publisher: ACM Press
Full text available: pdf(536.09 KB) Additional Information: full citation, abstract, references, index terms

This paper introduces a shading model for light diffusion in multi-layered translucent materials. Previous work on diffusion in translucent materials has assumed smooth semi-infinite homogeneous materials and solved for the scattering of light using a dipole diffusion approximation. This approximation breaks down in the case of thin translucent slabs and multi-layered materials. We present a new efficient technique based on multiple dipoles to account for diffusion in thin slabs. We enhance this ...

Keywords: BSSRDF, diffusion theory, global illumination, layered materials, light transport, realistic image synthesis, reflection models, subsurface scattering

19 Image-based transparency and refraction: Acquisition and rendering of transparent and refractive objects
Wojciech Matusik, Hanspeter Pfister, Remo Ziegler, Addy Ngan, Leonard McMillan
July 2002 **Proceedings of the 13th Eurographics workshop on Rendering EGRW '02**
Publisher: Eurographics Association
Full text available: pdf(16.22 MB) Additional Information: full citation, abstract, references, citings, index terms

This paper introduces a new image-based approach to capturing and modeling highly specular, transparent, or translucent objects. We have built a system for automatically acquiring high quality graphical models of objects that are extremely difficult to scan with traditional 3D scanners. The system consists of turntables, a set of cameras and lights, and monitors to project colored backdrops. We use multi-background matting techniques to acquire alpha and environment mattes of the object from mul ...

20 Point-based computer graphics
Marc Alexa, Markus Gross, Mark Pauly, Hanspeter Pfister, Marc Stamminger, Matthias Zwicker
August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes GRAPH '04**
Publisher: ACM Press
Full text available: pdf(8.94 MB) Additional Information: full citation, abstract, citings

This course introduces points as a powerful and versatile graphics primitive. Speakers present their latest concepts for the acquisition, representation, modeling, processing, and rendering of point sampled geometry along with applications and research directions. We describe algorithms and discuss current problems and limitations, covering important aspects of point based graphics.

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